December 21, 2017

Dennis J. Greene, PE
Design Review Section Supervisor
NH Department of Environmental Services
Wastewater Engineering Bureau
29 Hazen Drive; PO Box 95
Concord, NH 03302-0095

RE: Response to Comments on Draft Facility Plan
Newport, NH – Phosphorus Removal Upgrade Facilities Plan Project
Fuss & O'Neill Project No. 20141185.B10

Dear Mr. Greene,

Below are our responses to the comments and questions received from the New Hampshire Department of Environmental Services on November 27, 2017 regarding the draft Facility Plan for the Newport, NH Phosphorus Removal Upgrade Project:

Existing Facilities

1. At the end of Section 3.2 – Was hydraulic testing performed with new, clean filter media, or with filter media that had been possibly degraded after prior clogging? Please clarify.

Answer: *Yes, pursuant to the Existing Disc Filter Field Testing memorandum provided in Appendix C of the Facility Plan, hydraulic testing was performed on both the new, clean filter media and the degraded filter media.*

Text has been added in Section 3.2 to clarify this.

Alternatives Development

Solids Contact Clarification

2. Section 5.2 – Couldn't the solids contact clarification alternative be coupled with refurbished existing filters for a viable treatment alternative?

Answer: *Yes, solids contact clarification could be coupled with refurbishing and increasing the hydraulic capacity of the existing disc filters for a viable treatment alternative. As identified in Section 7 of the report, this alternative was in fact considered for further evaluation.*

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Major cost components of this alternative involve the capital costs associated with repairing and rehabilitating the existing filters, which are damaged. It also requires installation of additional units for the manufacturer to certify compliance with the design flow as well as to meet the redundancy requirements of TR-16. Integrating additional units requires modification of the influent concrete channel for control of flow diversion and splitting. There are also siting issues, specifically there is insufficient room in the existing filter building for installing additional units. Based on the Alternative Life Cycle Cost Analysis presented in Section 8 of the Facility Plan, this alternative did not present the lowest net present value, therefore it was not selected for pilot testing.

The capital cost associated with a new solids contact clarification process and refurbishing and increasing the hydraulic capacity of the existing disc filters is greater than that of a standalone process such as a ballasted floc separation process. Operation of a single process (e.g. ballasted flocculation) versus operation of two processes (e.g. solids contact clarification and disc filtration) has obvious operational and maintenance advantages as well.

3. Section 5.2.1 – Could set-up for Stowe (Claricone followed by disc filters) be replicated in Newport if the existing filtration system was refurbished and/or expanded (see Section 5.4.3)?

Answer: *Similar to the previous response, yes, a solids contact clarification process such as the Claricone could be coupled with refurbishing and increasing the hydraulic capacity of the existing disc filters for a viable treatment alternative.*

Based on budgetary proposals from vendors, the capital cost for the Degremont DensaDeg was the least expensive solids contact clarification process; therefore that system was chosen as part of Alterative No. 1 in Section 7 for further consideration.

Based on the Alternative Life Cycle Cost Analysis presented in Section 8 of the Facility Plan, Alternative No. 1 did not present the lowest net present value; therefore it was not selected for pilot testing.

In addition, such an alternative again involves operation and maintenance of two processes rather than a single process, as described in Item 2 above.

4. Section 5.2.2 – Could Densideg followed by disc filters be used in Newport if the existing filtration system was refurbished and/or expanded (see Section 5.4.3)?

Answer: *Yes, the Degremont DensaDeg coupled with refurbishing and increasing the hydraulic capacity of the existing disc filters could be a viable treatment alternative. In fact, this treatment option was identified as a viable alternative in Section 7 of the Facility Plan and was considered for further consideration.*

Based on the Alternative Life Cycle Cost Analysis presented in Section 8 of the Facility Plan, the Degremont DensaDeg system coupled with refurbishing and increasing the hydraulic capacity of the existing disc filters did not present the lowest net present value; therefore it was not selected for pilot testing.

In addition, such an alternative again involves operation and maintenance of two processes rather than a single process, as described in Item 2 above.

5. Section 7.1 – (solids contact clarification and disc filtration). It is stated that both alternatives require less chemical addition and produce less sludge because of 2-point chemical addition, but the cost evaluation in Table 8.1 does not reflect this. Section 7.3 (ballasted clarification) would have 1-point chemical addition and therefore would use more chemical and produce more sludge. Additionally, ballast media loss would increase solids production.

Answer: *Agreed. Table 8.1 has been updated accordingly.*

Dissolved Air Floatation

6. Section 7.2 (air flotation and continuous backwash filtration) - See comment 5 above.

Answer: *Agreed. Table 8.1 has been updated accordingly.*

Ballasted Clarification

7. P34 – Ballasted Clarification Equipment - Effluent phosphorus level for CoMag is reported to be 0.2 mg/L, and 0.3 mg/L for Actiflo and Densideg. Is this projection based on piloting data? Do values reported in Table 5.4 represent average or minimum values? (Note statement in Appendix G: "*Based on the results of this analysis and pilot testing, there was no objectively, clear recommendation that can be made between the two vendors".*)

Answer: *The effluent phosphorus levels shown in the tables in Section 5.4 are estimated phosphorus performance levels based on vendor literature for the purposes of screening. The row title for each table in Section 5.4 has been updated to clarify as such. We have also updated these values for Actiflow and CoMag; both are now listed as 0.20 mg/L..*

Based on the pilot testing, it is correct that there is no objectively, clear recommendation that can be made between the two vendors.

Pilot Testing

8. P45 – Section 8.2 – Pilot Testing Program – Was aluminum sulfate used at any time during piloting? If so, how did it perform compared with other coagulants?

Answer: *Pursuant to* *<u>Pilot Testing Summary Report</u>* *presented in Appendix G of the Facility Plan, at the suggestion of one of the pilot vendors, aluminum sulfate (Alum) was used for a week during pilot testing.*

Under typical operating conditions, the Actiflo process was able to achieve less than 0.35 mg/L effluent TP with Alum, but no stress testing was performed during this third week. Several of the samples were taken before the unit had been optimized with Alum. The optimal Alum dose for typical operations was determined to be 170 mg/L while also utilizing the Hydrex 3750 polymer at 1.20 mg/L.

The CoMag unit produced effluent results within the target range when using aluminum sulfate as a coagulant. BOD5 and TSS were below the detection limit of the test when both Ferric and Alum were used, and close to the limit of detection with PACL. Considerable alkalinity was consumed with both Ferric and Alum, and much less so with PACL. However, Ferric and PACL had minimal detections of total aluminum in the effluent, while Alum effluent had an average of 0.55 mg/L. Ferric and PACL exhibited the lowest UVT at roughly the same average of 74.5%, Alum was slightly higher at 77.1%. Alum produced sludge with the highest percent total solids of 1.2%, Ferric was in the middle with an average of 0.9%, and PACL was the lowest at 0.7%. However, PACL had the lowest TP in the supernatant at 0.4 mg/L, Alum was very unexpectedly high at 14 mg/L, while Ferric was higher with an average of 1.65 mg/L.

Section 8.2 has been revised to indicate that aluminum sulfate was used as a coagulant for one week.

9. Table 8.2 – Were proprietary chemicals used in the Actiflo system?

Answer: *Pursuant to the Analysis of Non-Monetary Factors memorandum in Appendix H of the Facility Plan, the coagulants used during pilot testing were readily available for each vendor and provided by the Town. The Actiflo process used a proprietary polymer from Veolia, while the CoMag unit utilized a dry anionic polymer by Aries.*

10. Densideg – Was analysis of prior Densideg piloting data performed? Does data indicate that effluent polishing would be required downstream of Densideg?

Answer: *No, previous pilot testing data that was conducted at the Newport WWTF was not analyzed as part of this Facility Plan.*

11. Sludge Dewatering – Was dewaterability testing of ballasted clarification sludges performed during pilot program? Will additional sludge dewatering pilot testing be required to finalize design?

Answer: *Yes, sludge samples from each pilot test unit were sent out for bench testing during the pilot testing phase, however the sludge quantities were understandably of limited volume and therefore difficult to draw definitive conclusions.*

Based on the variability and the chemical makeup of the sludge, a phased project approach consisting of two separate projects is recommended, wherein the phosphorus upgrade project will be followed by a sludge dewatering project. It is recommended that the first project address the bulk of the work including the following:

- *Providing a new ballasted floc separation system*
- *Providing a new pre-engineered building to house the ballasted floc separation process*
- *Converting the existing chlorine contact tank into a sludge holding tank*
- *Providing a UV disinfection channel*
- *All yard piping modifications*
- *Establishing a dedicated area for the sludge dewatering equipment and disposal*

Once that project is complete, pursuant to the New Hampshire Code of Administrative Rules, prior to selecting the mechanical dewatering equipment, pilot testing will be performed to establish design criteria. After the design criteria is established, Contract Documents will be developed and subsequently put out to bid as a separate project.

Alternatives Analysis

- ***Solids Contact Clarification/Disc Filtration***
- ***DAF/Continuous Backwash Filtration***
- ***Ballasted Clarification***

12. Table 8-1 – Why are items in the "additional annual operating costs" section so much less for the ballasted clarification alternative (e.g, labor and maintenance)? Should residuals cost for ballasted clarification be higher than other alternatives?

Answer: *The annual operating costs shown for labor and maintenance are significantly less for the ballasted floc separation alternative because that is one stand-alone system, whereas the other alternatives consist of two treatment processes. Notes have been added to Section 8.1 to clarify the discrepancy in costs.*

The residual cost for ballasted clarification should be higher than the other alternatives. Table 8-1 has been updated to reflect such.

13. Table 9.2 – Why is the Evaqua CoMag system so much less expensive than the Kruger Actiflo system? See first line item in "phosphorus removal process".

Answer: *The capital costs shown for Evoqua's CoMag and Kruger's Actiflo are based on proposals provided by the vendors. Subsequent to our meeting we requested updated costs from the vendors, and the tables within the Facility Plan now reflect the most up to date budget costs from the vendors.*

14. Life Cycle Cost Analysis – What is impact of assumed 3.5% discount rate? Was a sensitivity analysis on this parameter performed?

Answer: *Upon further review, pursuant to New Hampshire Code of Administrative Rules, discount rates shall be based on the discount rate shown in Appendix C of OMB circular A-94. That appendix indicates that a discount rate of 2.5% shall be used.*

The life cycle cost analyses have been updated with this required discount rate. When we applied the 2.5% rate in the life cycle cost analysis, we found that it increased the Annual O&M present worth, having a minimal impact and did not change the relative ranking of the alternatives.

Recommended Phosphorus Alternative

15. There is very little re-use of the existing filter building/equipment. Can the existing building be re-used/expanded for the new ballasted clarification process?

Answer: *The Recommended Project in Section 9 of the Facility Plan has been revised to indicate that the sludge dewatering equipment will be housed in the existing disc filter building.*

Furthermore, pursuant to our discussion at our meeting on November 27, 2017, a new section has been added to Section 9 of the Facility Plan detailing potential aspects of the filter building that will be considered for reuse during the design phase of this project.

16. Does the ballasted clarification process tankage need to be in a building? For example, Actiflo tankage at the Jaffrey NH WWTP is not in a building.

Answer: *We have solicited input from the vendors to see if the process equipment could potentially be outside, perhaps covered under an open structure, and a vendor recommended that the process equipment be located indoors in order to protect it from the New England environment. The Facility Plan now includes a recommendation to perform a competitive preselection of the ballasted process supplier early in the design phase, and this topic can be included as a component of the qualification and scoring evaluation.*

17. Section 9.1 – New chemical equipment and new coagulation and flocculation tanks are proposed. Can't these systems be located in the existing filter building? Reuse existing coagulation and flocculation tanks?

Answer: *The ballasted floc separation processes are proprietary and their systems require specific detention times in each tank, therefore it is not envisioned that the existing coagulation and flocculation tanks can be reused. However, this is a potential cost savings and will be verified with the preselected vendor during the design phase.*

<u>Recommended Dewatering Alternative</u>

18. Will an odor control system be necessary for the covered sludge holding tank (existing chlorine tank)?

Answer: *Per the process vendors, the chemical sludge generated from ballasted floc separation processes is very low in organics; therefore it reportedly doesn't have as potent an odor. That being said, this is a valid concern, therefore a provisional allowance has been established in the Opinion of Project Cost for odor control given the plant is close to the Town High School and other residential properties.*

19. Section 9.3 – Sludge Thickening and Dewatering – Where would the proposed sludge transfer pumps reside? Depending on the dewatering technology chosen, highly thickened sludge is not desirable. Our understanding is that centrifuges and screw presses work best with sludge in the 1.0 to 1.5% solids range.

Answer: *It is tentatively proposed that submersible sludge feed pumps reside in the proposed sludge storage tank, however as mentioned above, pilot testing for dewatering treatment alternatives will be conducted after the ballasted floc separation process is online and an accurate conclusion can be made regarding the sludge composition. The information at this juncture will dictate whether sludge thickening is necessary.*

<u>Project Cost</u>

20. DES recommends a value engineering study for this project after the preliminary design is completed.

Answer: *As discussed during our meeting on November 27, 2017, a value engineering study has been added to the project schedule, and can be performed after the preliminary design is 30% complete.*

Project Plant Upgrades

21. DES requested in prior meeting that the plan focus on phosphorus removal . Nonetheless, does recommended alternative consider provisions for possible future plant upgrades (e.g. nitrogen). For example, would the current plan allow for inclusion of potential future nitrogen removal processes in the hydraulic profile without a third pump station? (influent and phosphorus treatment pump stations would already exist)

Answer: *Fuss & O'Neill was not under contract to review potential nitrogen removal processes. It is difficult to answer this question with 100% certainty having no knowledge what the future nitrogen limit might be for Newport.*

One future upgrade identified within the Facility Plan that would improve nitrogen removal would consist of covering the lagoons and improving the mixing and aeration within the lagoons. This upgrade would also address the whole effluent toxicity (WET) violations that the treatment facility typically experiences.

When performing design of the phosphorus upgrade, the potential for future nitrogen removal and avoidance of additional pumping will be considered. This topic can also be revisited during the Value Engineering event at the 30% complete milestone.

Project Design Criteria

22. Flow Peaking Factors – Only two years of flow data analyzed? Should be at least 5 years.

Answer: *The report has been updated to include a review of 5 years of flow data.*

23. Figure 3-8 – Influent TKN and TP data available?

Answer: *The Newport, NH WWTF does not record influent TKN or TP, therefore this data was unavailable.*

24. P19 – Table 3.4 – What is basis for Influent TP concentrations to lagoons (3 – 6 mg/L)?

Answer: *This column has been removed from Table 3.4.*

25. Mass Balance – Any major conclusions/observation drawn from mass balance analysis?

Answer: *Based on the mass balance, the strength of the influent wastewater is approximately twice as strong as the influent design criteria from the 1988 upgrade (BOD5 = 1185 lbs/day, and TSS = 1340 lbs/day). Conservative reaction coefficients were used for the lagoon calculations and based on these calculations, it can be concluded that the facility can and should meet the discharge permit limits at the current flows and loads.*

However, the facility may start to run into issues meeting the permit limits as flows increase, assuming that the influent wastewater strength remains unchanged.

Section 4.4 has been modified to identify these conclusions from the mass balance.

26. Section 3.4.2 – Is the flow amount of 25,000 gpd adequate for an inflow amount during a rain storm? It seems to be a very low value. Is most of the excess flow really infiltration?

Answer: *Agreed. The report has been slightly revised to indicate that rainfall derived infiltration and inflow account for 500,000 GPD.*

27. Section 3.4.3 – The project flow for year 2020 is stated to be 0.81 mgd. Current average flow is estimated to be 0.40 mgd (see p 16). Will flow actually double between today and 2020?

Answer: *The base wastewater flow is 400,000 GPD, which is exclusive of base infiltration. The annual average flow (including base infiltration and rainfall derived inflow and infiltration) experienced at the plan is 0.73 MGD. The projected flow of 0.81 MGD is in line with the current average of 0.73 MGD.*

We trust that the responses provided above are satisfactory and answer any questions you have. If you have any further comments or questions, please do not hesitate to contact me. We look forward to working with the Town and NHDES in making this a successful project.

Sincerely,

Virgil J. Lloyd, P.E.
Senior Vice President